

## **Logistics Locations in the GTA: Context and Industry Perspectives**

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### **Introduction**

Investigations into the location factors that influence spatial interactions have a long history. From Von Thunen's early investigations of agricultural land use to recent correlations of city development to the presence of a creative workforce, understanding the location choices of businesses underlies our desire to understand how and why firms will develop and locate in one country versus another, one city or another. The location choices of Distribution, Warehousing, and Logistics (DLW) firms have been subject to less scrutiny. They do not employ many city residents compared to other types of industry such as manufacturing, and they are not seen to add as much value to a community in terms of fostering a skilled labour force (Hesse, 2008).

While the presence of DLW firms is necessary to facilitate the delivery of goods for both businesses and consumers, the specific location of their facilities place a disproportionate burden upon residents in their vicinity because of the negative impacts of freight traffic, including the noise of potentially 24 hour operations. With these considerations in mind, the lack of attention paid to DLW firms compared to other sectors by academics is surprising. For transportation planners, the locations of these firms will dictate at least one end of the vast majority of freight movements, which in turn will determine how freight flows through our regions and cities.

This paper will concentrate on the siting of facilities whose primary function it is to handle freight movements. This includes truck terminals, warehouses, and distribution centres. It is important to note that identifying such businesses is difficult as some manufactures or retail stores will have facilities for storing goods before or after shipment to final use. Furthermore these businesses are not easily identifiable by industry classifications such as NAICS<sup>1</sup>. Additionally, contemporary DLW firms incorporate value-added functions into their operations which were previously performed at either the manufacturer or retailer complicating classification matters further.<sup>2</sup>

For the most part, the movement of goods through the economy is organized and performed by private firms. The business environment that they exist within governs how their location choices are made, which includes the transactional environment, business practices, and the organization of other actors within the supply chain (Hesse & Rodrigue, 2004). It may be worthwhile to note that often this business environment does not aspire to the same goals as are found within the public sector, and this mismatch of interests can lead to a lack of understanding between private providers of supply chain services, and public providers of transportation infrastructure and municipal services. For public decision makers it would be worthwhile to identify the centripetal forces that keep DLW firms within a region compared to centrifugal forces that pull them out. The goal of this paper is to explore this interplay between private firms and public elements, specifically seeking to understand what influences the location choices of DLW firms within the Greater Toronto Area (GTA), and how these firms deal with congestion on the largely public road network.

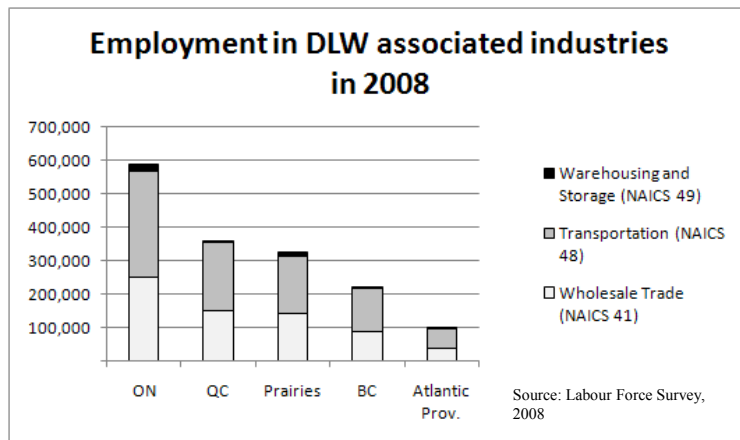
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<sup>1</sup> NAICS (North American Industrial Classification System) The variety of business models that perform distribution, logistics and warehousing functions are found within NAICS classifications of Wholesale Trade (41) and Transportation and Warehousing (48&49) according to (Hesse, 2008).

<sup>2</sup> Commonly, 3<sup>rd</sup> party logistics providers (3PLs) are used by manufacturers and vendors to handle their warehousing and distribution operations. These businesses regularly provide value-added services to their customers.

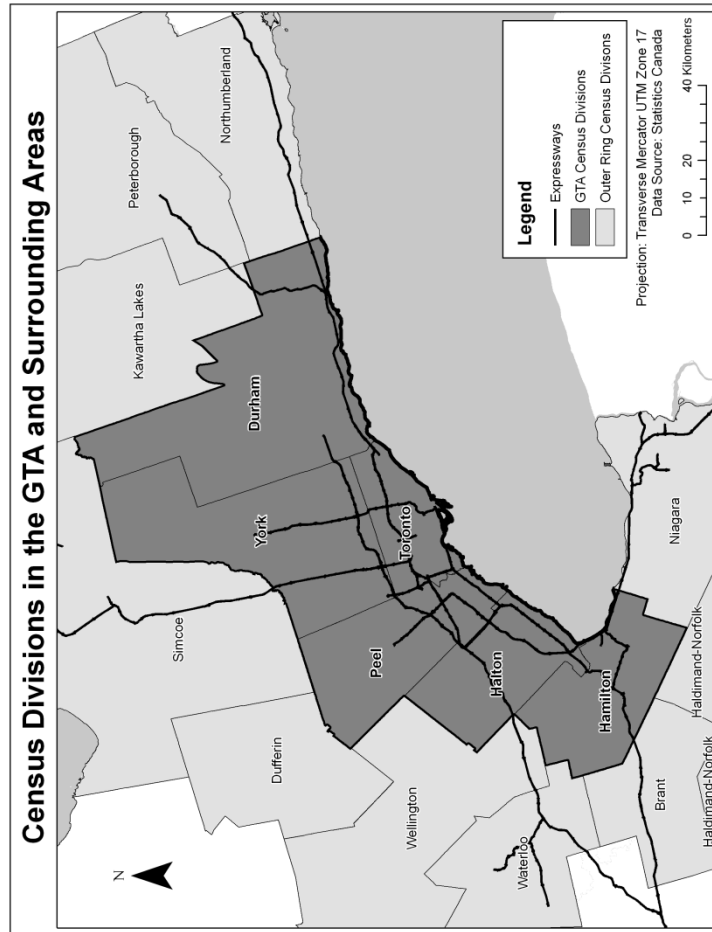
### Location of Logistics Activities in Canada and the GTA

To determine the locations of logistics activities within Canada and the GTA the Canadian Business Registry, and the Labour Force Survey were used. According to employment data, Ontario dominates logistics activity in Canada. The number of persons employed in sectors associated with logistics in Ontario is approximately 590,000. Of these employees about half (280,000) are found within the Toronto CMA<sup>3</sup> (Statistics Canada, 2008).

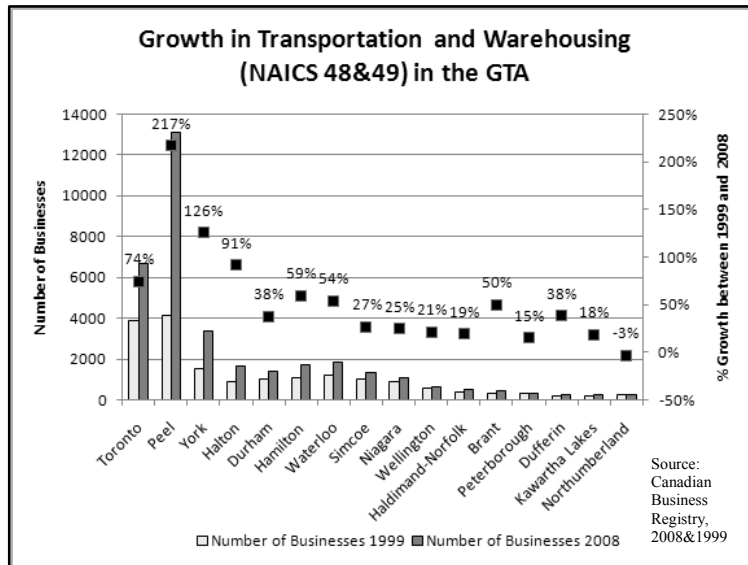


The GTA is observed in the larger regional context, along with the Census Divisions that surround its limits. A map of the area is provided below. Through examination of the number of business establishments in and around the GTA, we can observe that both the number and growth of these establishments between 1999 and 2008 is not evenly spaced throughout the region. While Toronto itself has experienced growth in the number of transportation and warehousing businesses, highest rates of growth over this time frame are found in the immediately adjacent census divisions such as Peel (217%) and York (126%).

<sup>3</sup> The Toronto Census Metropolitan Area (CMA) is not exactly the same spatial delineation as the GTA, however the magnitude of logistics activity in the region is apparent.



Outer ring census divisions, those outside the GTA but adjacent to its borders experienced less growth. The two fastest growing outer ring census divisions were Waterloo (54%) and Brant (50%). Both these areas are on the west side of the GTA, located on transportation corridors that connect the GTA to US markets.



From employment and labour data we can infer that the Census Divisions immediately adjacent to Toronto have the most DLW firm activity and highest growth in recent years. Some growth in outer ring census divisions has occurred, especially in specific regions.

### Our Current Understanding

Explanations of DLW firms' location choices have traditionally been seen as the result of minimizing distances between suppliers and customers. This view has its roots in Weber's (1928) hypothesis that a firm's location will be dependent on the relative expense of the transport costs of inputs versus the transport costs of finished products. Contemporary operations research minimizes these costs through the p-median problem, which incorporates more cost variables in order to determine the most efficient site or sites (Melo, Nickel, & Saldanha-da-Gama, 2009). However, within discussions of DLW firm location choices, it has been hypothesized that simple transportation costs based on distance are not a good indication of the total spatial interaction costs that firms face (McKinnon, 1999).

<b>Table 1: Overview of Literature</b>		
<b>Theme</b>	<b>Major Point/Summary</b>	<b>Authors</b>
<b>Spatial transaction Costs</b>	Time is more important than distance These costs are interpreted within the context of firm structure	(McKinnon, 1999) (Hesse & Rodrigue, 2004)
<b>Location Relative to Customers and Suppliers</b>	Smaller facilities value proximity to consumer areas higher than larger facilities Proximity to customers is more important than to suppliers	(Sivitanidou, 1996) (Holl, 2004)
<b>Congestion</b>	More facilities may be sited as a response to congestion There is a temporal lag between logistics development and traffic congestion	(McKinnon, 1999) (Woudsma et al., 2008)
<b>Intermodal</b>	Increasing air congestion can lead to a modal shift to road Observes the movement of freight-related establishments to inland ports in the US	(Warffemius, 2007) (Cidell, 2009)
<b>Site Characteristic Needs</b>	Number of Dock doors and other site considerations are based on the operation that is occurring at the site, ceiling height, and place for truck turnarounds are necessary.	(Yap & Rene, 2003)
<b>Zoning/Operational Requirements</b>	Zoning issues can affect operations at night, and the availability of truck parking as 'outside storage' Residential encroachment on industrial lands will interfere with operations Road and intersection geometry hampers truck movements	(iTrans Consulting, 2004) (Canadian Urban Institute, 2000) (Gordon, 2005)
<b>Labour</b>	2/3 of the jobs in the logistics industry are white collar, there is a trend towards increasing automation, increasing productivity and reducing employment Proximity to blue collar workforce is important, but not as important as in manufacturing because of low numbers of employees per square foot	(Canadian Urban Institute, 2000) (Yap & Rene, 2003) (Sivitanidou, 1996)
<b>Agglomeration</b>	DLW firms are leading/pioneering industrial suburbanization Some companies will become 'locked-in' to a location because of factors such as proximity to an airport	(Hesse, 2008) (Warffemius, 2007)

Table 1 above provides an overview of location influence factors for logistics operations drawn from recent literatures. From the firm's point of view, spatial transaction costs incurred within a supply chain cannot be divorced from inventory and facility costs which are other considerations that dictate the number of facilities to be located, their capacities, and their relative locations (Chopra & Meindl, 2004). Furthermore, a sub-optimal supply chain network design can be profitable if costs incurred by a firm will be compensated for by customer demands for responsiveness. It is not surprising to find that proximity to customers has been observed to be more important than to suppliers for DLW firms (Holl, 2004). The characteristics of a DLW firm may also influence these choices as Sivitanidou (1996) found that smaller warehouses tend to be located closer to markets than larger facilities.

When viewing generic firms and their relationships to infrastructure, empirical evidence shows that they locate close to high quality roadways (Kawamura, 2001). DLW firms specifically, have recently been shown to value access to roads and airports over rail and

seaports (Bowen, 2008). The establishment of inland ports is also a trend of interest. In the US, major rail intermodal facilities are associated with growth in DLW facilities above the need to serve local populations in places like Kansas City, Dallas-Fort Worth, and Columbus, Ohio (Cidell, 2009). In the Canadian context, Winnipeg has been the subject of interest with attempts by governments to promote the growth of an inland port (CentrePort Canada, 2010).

On a local scale, DLW firms wish to operate within a particular operational environment. Most commonly, DLW firms require a site where they can operate on a 24/7 basis, where they have room and capabilities of handling incoming and outgoing freight, and road geometry that supports heavy traffic. Additionally, the capability to park trailers outside of the building so that their contents can be used 'just-in-time' is another location factor that is taken into consideration with zoning restrictions often hampering these operations (iTrans Consulting, 2004).

In many regions throughout the world, the suburbanization of DLW firms has been observed (Hesse, 2008). The GTA has experienced this as well, with industry commentators discussing the growth of warehousing facilities in the Brantford, Cambridge and Guelph areas, which is reflected in our prior discussion of DLW employment (Donahue, 2007).

### **Methods and Results**

To understand how DLW firms have come to locate within the GTA and surrounding area and the impacts that congestion has upon these decisions, interviews were carried out with logistics professionals who were aware of how location decisions of their firms were made. Ten participants were recruited from postings on the Supply Chain and Logistics Canada e-newsletter, an industry organization, and subsequently interviewed over the phone.

Table 2: Summary of Findings		
Spatial transaction Costs	Increasing trend of a responsive supply chain, driven by tight delivery time requirements, including fines	Confirms
	Proximity to Airports is critical for freight forwarders	Confirms
	Proximity to courier hubs for speed of cut-off times for delivery	Elaborates
	Fuel costs will not influence facility locations because of willingness to pay fuel surcharges	Not Mentioned
Relative location to Customers and Suppliers	Decrease in reliance on air for international transportation	Not Mentioned
	Firms will do optimization studies for site selection, then not implement results	Not Mentioned
	Proximity to customers more important than to suppliers	Confirms
	Proximity to Airports is critical for freight forwarders	Elaborates
Congestion	Proximity to courier hubs for speed of cut-off times for delivery	Not Mentioned
	3PLs will centralize multi-client facilities	Not Mentioned
	Chronic congestion will cause facilities to be located closer to their customers	Confirms
	One respondent moved from Oakville to Guelph, a primary consideration was to avoid traffic on QEW	Confirms
Intermodal	Toronto isn't a city like New York, where the operational environment dictates that deliveries be handled by local companies	Not Mentioned
	Rail services are unreliable	Confirms
	Rail serves primarily inbound transportation	Not Mentioned
	Proximity to rail intermodal facilities not very important	Somewhat Contrary
Site Characteristic Needs	Proximity to Hamilton airport not critical, cut-off times are at night, international movements are through Pearson	Not Mentioned
	Parking requirements don't take into account actual needs of businesses	Confirms
	Problems with trailers as 'outside storage'	Confirms
	Road Geometry problems, especially in Toronto	Confirms
Zoning/Operational Requirements	Mississauga and Toronto "Don't want us here"	Elaborates
	Want flexibility to increase/decrease shifts and traffic and business increases/decreases	Elaborates
	Planners do a poor job in segregating uses, leading to potential conflict	Elaborates
	Labour force will be a firm to its location, except for some carriers who hire O/O	Elaborates
Agglomeration	Hours of Service regulations, truck driver demographics will result in an increase in the number of facilities	Not Mentioned
	Local Sales force can be a deciding factor in keeping facilities open	Not Mentioned
	'Unskilled' labour is valuable due to the amount of training that is required	Somewhat Contrary
	Need to be close to marketplace is crucial in keeping firms within the built environment	Elaborates
	Locating in periphery will reduce costs, but is associated with an increase in transportation costs and responsiveness	Elaborates
	Logistics Campuses as a way to share reduce transportation costs	Elaborates



To a large extent, results of the interviews (see Table 2) confirmed many of the location influences prevalent in the literature, or elaborated on them in the local context. Respondents also described factors that have not been discussed in the literature and observations were made that contradict observed trends. Strategies that have been used by firms to minimize the effects of congestion will be noted.

Participants confirmed observations that transportation costs in themselves do not incorporate the importance of quick and reliable deliveries, which have a higher impact on siting considerations. Specific causalities that have not been discussed in the literature were explained by participants. For example, there were several comments made regarding the impacts of fuel surcharges on their operations, which can be seen as a proxy for estimating the changing cost of transportation. Participants mentioned that fuel surcharges, even those large increases that were seen in 2007-2008 will not necessarily have an impact upon the number of facilities that will be located. Instead, proximity to customers was cited as the deciding factor for many participants, especially those involved with retail distribution. Where fuel price increases may have an effect was speculated upon by one participant who represented a freight forwarding concern. As a result of the price hikes of a couple of years ago, he has seen a decrease in air traffic, and speculated that into the future the use of air transport will be 'merely a safety valve' for those consumer goods that do not absolutely have to travel by air, such as some foodstuffs and flowers.

The process of making decisions within firms can also have an impact on the ultimate location choice. Three participants who represented 3PLs observed that their customers will undertake extensive optimization studies, through which they will decide the optimal location for facilities through pre-determined criteria deemed important for that firm. However, upon completion of these studies, the information can be disregarded by the executive decision-maker in the firm, and often transportation inefficiencies result. The disregard of optimization exercises was noted to be more prevalent among firms whose parent companies are foreign based. On the other hand, two participants specifically mentioned that they do include considerations such as vehicle routing into their facility planning

process. With limited responses available for analysis it is unclear what generalizations can be made about the inclusion of optimization studies into the facility siting process. However, some firms will weigh other factors more importantly than the minimization of transportation costs. This may be a concern from a public standpoint since this could conceivably lead to higher vehicle kilometers of travel, and is generally inefficient.

The relative importance of proximity to customers versus suppliers are location factors that will have an impact on the design of the firm's supply chain, and realized outcomes of differing patterns of firm locations. It has been noted that the tendency will be to locate closer to customers because of the desire for quick cut-off times, but as far away as possible from high land values (Hesse, 2008). The importance of cut-off times was reiterated many times by participants. Proximity to courier hubs to take advantage of their cut-off times and to the airport were seen as critical considerations for locating their sites by two participants. 3PLs can operate in two different ways: they can operate a facility dedicated for one client; or they can utilize the same facility to serve many clients. Only one participant commented on the differences between these kinds of 3PL facilities, where for the former they will work with the client to select a facility for that suits them, for the latter facilities are sited based on serving perceived critical Canadian markets, Toronto and Calgary.

The growth of interest in inland ports and associated logistics developments supposes that firms cluster around inland ports to take advantage of rail and air services (Cidell, 2009). However, respondents did not weigh proximity to rail intermodal yards heavily, although participants saw an importance in regional availability of rail intermodal yards. The reasoning was that rail services provided their inbound transportation, which was not as time-sensitive as their outbound, and as one respondent put it 'why locate next to a rail facility, drayage costs are [a flat rate] across the GTA.' Combined with the fact that cut-off times for rail are known at least a day in advance were perceived as reasons for not being strongly drawn towards rail intermodal yards. From a public standpoint this is another example of a sub-optimal consideration as firms do not

consider distance as important, leading to a possible increase in vehicle kilometers. However, respondents noted indirect effects whereby large rail yards attract transportation support services, and these in turn will attract logistics businesses. So in fact the attraction to locate nearby intermodal facilities may be occurring, but not because of the intermodal yard itself, but because of the ancillary services that it attracts.

The availability and quality of the labour force was seen as an important location factor for the participants, almost without exception. Interestingly, labour that would be classified as 'unskilled' was seen as quite valuable by some respondents because of the amount of investment in this human capital. This would include forklift operators and others. Another participant mentioned that unskilled workers had to be paid a decent wage because of the responsibility that they have in ensuring a safe work environment, and attempts to keep worker's compensation claims down. Where 'unskilled' workers were not seen as valuable was in simple picking operations to some extent, where they could be supplied by a labour agency; or the case of a participant who is not tied to the location of his employees because most are truck drivers who took their trucks home, therefore not tied to the location of the firm. The structure of the labour force that is described in the literature focuses on administrative staff and warehouse workers (Canadian Urban Institute, 2000). However, one respondent mentioned that the very existence of a facility gives a local sales staff a base to work from, and in some DLW sectors this is an important consideration.

### **Adapting to Congestion**

Keeping the aforementioned location strategies in mind, participants were asked about their strategies for addressing the effects of congestion. Within a supply chain firm, there are three levels of decision making and objectives to be fulfilled. Strategic level decisions involve long term considerations and include the siting of facilities. Tactical level decisions include the selection of transportation modes and inventory policies, those decisions that can be made on a quarterly to yearly basis. Operational level decisions

involve vehicle routing and scheduling, and are made on a daily or weekly basis (Chopra & Meindl, 2004).

Congestion mitigation strategies discussed by participants focused on strategic or operational level adaptations. One of the participants had moved out of the GTA from Oakville, leapfrogging the protected area that surrounds the GTA known as the greenbelt, to Guelph in the Wellington census division. One of the major reasons given by this participant was the motivation to be out of the congested QEW expressway corridor, to the relatively less congested Highway 401 corridor. Interestingly, this firm considered moving to Brantford as well, also outside of the greenbelt, but one reason against this choice was that access to the GTA from Brantford necessitates travel along the QEW corridor. Out of the ten participants, this participant's firm was the only one contacted that had moved outside of the GTA. So not only does the severe congestion along the QEW affect the location of firms along this corridor, but it affects the ability of peripheral locations like Brantford to attract DLW development.

Within Toronto as well, one participant located in the western part of the GTA discussed the possibility of his firm in locating another warehouse on the east side in order to avoid congestion. This comment is a further indication of spatial transaction costs are being governed more by time than distance. This is underscored by participants' discussions of not being greatly influenced by fuel surcharges and the price of fuel, but being influenced by speed and reliability to markets. Indeed, strategies to increase reliability of delivery time included moving closer to customers, or closer to courier hubs. The size and congestion prevalent in a city region may also affect operation strategies. One respondent discussed that the sheer size and amount of congestion in the New York metropolitan area prevents GTA firms from performing deliveries there on their own, necessitating collaboration with New York companies. He speculated that if Toronto grows to a similar size, then the characteristics of firms will change as well.

Several participants mentioned that often congestion and/or fuel price increases will lead to a rise in innovations and scheduling changes, which are operational level adaptations. This includes organizing

driver's days around congested periods, or moving deliveries to the night time. One participant mentioned that major retailers are moving to night time 'unassisted' deliveries, where the driver is given a swipe card to access the customer's premises during the night and performs the delivery without the assistance of store employees. This strategy saves time during delivery, but also results in less truck trips to the store.

### **Discussion**

Through the course of conducting interviews with logistics professionals, it is apparent that there are no consistent reasons for firm's location choices that could be generalized to all DLW operations. DLW firms operate within a specific framework of fulfilling the needs of their customers first, and design their supply chains accordingly. The results of this study may not be representative of the entire DLW firm population; responses are dependent on the structure of the type of business and the size and nature of the urban area.

Key findings applicable to participants in the study area include:

- Time is more important than distance
- Proximity to customers is becoming more important
- Reactions to congestion start with operational level innovations then strategic level reactions
- Under certain circumstances congestion may act as a centripetal force
- An established labour force is a significant barrier to relocation

The confirmation that time costs are more important than distance costs for DLW firms supports those commentators who have argued this point. Because of this, the potential effects of congestion may include the restructuring of supply chains, and changing the number and locations of facilities. However, for some firms this will result in more facilities being located closer to customers so that they can be served within strict delivery times demanded. So instead of firms moving out of areas of congestion, they may be forced to move

towards areas of congestion, or locate more facilities within a region to maintain delivery times. This hypothesis is extremely contextual, proposed here are three conditions which must be satisfied to cause this situation. Firstly, the DLW firm must be involved in serving customers that demand rapid deliveries, and these customer's facilities must be located within the congested area. Secondly, the size of the urban region will dictate whether the increased time costs incurred by locating outside of the urban region outweigh the costs of operating within a less than ideal, congested environment. Thirdly, land costs within the congested area cannot be prohibitive for the firm. The GTA may satisfy these conditions for many firms, including seven of ten participants in this study, and therefore we may not see widespread relocations of DLW firms out of the GTA.

Another centripetal force in keeping firms within the built environment of the GTA is the labour force. Not only skilled labour, but also unskilled labour and the firm's sales force are reasons to keep a DLW within the built environment of the GTA. Temporary, operational level adaptations to congestion allow firms to adapt to congestion, commonly to shift their operations to the nighttime. Centrifugal forces mentioned by participants included land costs or access to space for expansion, or conflicts with residential encroachment.

The preliminary nature of these results leads to the need for confirmation of trends from a more extensive study. This should include further investigation of the value of time according to varying DLW firm structures. Issues surrounding the location choices of DLW firms are complex with many layers of actors and there is opportunity to improve the knowledge of linkages between the characteristics of the built environment, the freight transportation sector, and public sector influences on these variables.

### **Acknowledgements**

The authors would like to thank both Supply Chain and Logistics Canada, as well as all the participants who gave their time and insights.

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